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3 PROJECTILE LAUNCH ASSEMBLY AND METHOD

4  
5 STATEMENT OF GOVERNMENT INTEREST

6 The invention described herein may be manufactured and used  
7 by the U.S. Government for Governmental purposes without the  
8 payment of any royalty thereon.  
9

10 BACKGROUND OF THE INVENTION

11 1. Field of the Invention

12 The invention relates to the launching of small projectiles,  
13 and more specifically is directed to an assembly and method for  
14 launching such projectiles from firearms, such as rifles.

15 2. Description of the Prior Art

16 Launchers which facilitate the firing of a projectile such  
17 as, for example, a rifle grenade, from a rifle are generally known  
18 and in use.

19 However, in non-combat situations, as in training, or the  
20 like, the launch assemblies, which may be readily recoverable, are  
21 not reusable. That is, even on a practice range the launch  
22 assemblies are adapted only for one-time use.

23 It will be apparent that economies could be realized if  
24 launchers which are readily recoverable could be used multiple  
25 times before discarding.



1           In accordance with a further feature of the invention, there  
2   is provided a method for launching a projectile from a firearm,  
3   the method comprising the steps of providing a projectile launch  
4   assembly comprising a launch tube having distal and proximal ends  
5   and an inwardly extending dimple therebetween, a receiver disposed  
6   on the distal end of the launch tube, the receiver having  
7   connector structure at a distal end thereof for connection to a  
8   projectile, an energy absorbing plug having a proximal end portion  
9   adjacent the dimple, a body portion extending distally, and an  
10   energy transfer piston adjacent the plug and having a proximal end  
11   configured complementarily to the plug and having a distal end  
12   configured complementarily to a proximal end of the receiver;  
13   manipulating the receiver connector structure to connect a  
14   selected projectile to the receiver; sliding the launch tube onto  
15   a muzzle portion of a firearm until a distal end of the muzzle  
16   portion engages the dimple; and firing the firearm. A bullet  
17   leaving the firearm muzzle is absorbed by the plug which is  
18   thereby moved with the piston distally in the tube. The piston  
19   engages the receiver to propel the assembly and the projectile  
20   from the firearm muzzle.

21           The above and other features of the invention, including  
22   various novel details of construction and combinations of parts  
23   and steps, will now be more particularly described with reference  
24   to the accompanying drawings and pointed out in the claims. It  
25   will be understood that the particular assembly and method

1        embodying the invention are shown and described by way of  
2        illustration only and not as limitations of the invention. The  
3        principles and features of this invention may be employed in  
4        various and numerous embodiments without departing from the scope  
5        of the invention.

#### 7                    BRIEF DESCRIPTION OF THE DRAWINGS

8                Reference is made to the accompanying drawings in which is  
9        shown an illustrative embodiment of the invention, from which its  
10       novel features and advantages will be apparent.

11               In the drawings:

12               FIG. 1 is an interrupted center line sectional view of one  
13       form of projectile launch assembly illustrative of an embodiment  
14       of the invention for low velocity ammunition;

15               FIG. 2 is a sectional view taken along line II-II of the  
16       whole assembly depicted in section in FIG. 1;

17               FIG. 3 is similar to FIG. 1 and is illustrative of an  
18       alternative embodiment of launch assembly for medium velocity  
19       ammunition; and

20               FIG. 4 is similar to FIGS. 1 and 3 and is illustrative of a  
21       further alternative embodiment of launch assembly for high  
22       velocity ammunition.

1                                    DESCRIPTION OF THE PREFERRED EMBODIMENTS

2                    Referring to FIGS. 1 and 2, it will be seen that an  
3                    illustrative embodiment of projectile launch assembly includes a  
4                    cylindrically-shaped elongated launch tube 10 having a distal end  
5                    12 and a proximal end 14. An inwardly extending dimple 16 is  
6                    disposed between the launch tube distal and proximal ends 12, 14.  
7                    The dimple 16 may be a continuous single annular dimple, as  
8                    illustrated, or a plurality of dimples arranged in annular  
9                    fashion.

10                  A collar 18 is mounted, as by threads or press-fit, on the  
11                  distal end 12 of the launch tube 10. The collar 18 is provided  
12                  with connector structure 20, such as screw threads.

13                  The assembly further includes a receiver 22 which is provided  
14                  at its proximal end 23 with connector structure 24, such as screw  
15                  threads, for connecting engagement with the collar connector  
16                  structure 20, to affix the receiver 22 to the launch tube distal  
17                  end 12. The receiver 22, at a distal end 26 thereof, is provided  
18                  with further connector structure 28, such as a threaded bore, for  
19                  connection to a stem 30 of a projectile. One such projectile for  
20                  which the launch assembly described herein is well suited is a  
21                  grappling hook generally of the type disclosed in U.S. Patent No.  
22                  6,079,761, issued June 27, 2000, in the name of James E. Sedeck,  
23                  and incorporated herein by reference.

24                  Mounted in the launch tube 10 is a circular plug 32  
25                  configured to fit snugly in the launch tube 10 abutting the dimple

1        16. The plug 32 includes a frusto-conical portion 34 extending  
2        from a planar portion 36. At a distal end 38 of the frusto-  
3        conical portion 34 there is disposed an end disc portion 40, or  
4        other such protuberance.

5                Connected to the plug 32 is a piston 42 provided with a  
6        proximal end 44 adjacent the planar portion 36 of the frusto-  
7        conical portion 34 and having a recess 46 therein in which is  
8        disposed the frusto-conical portion 34 of the plug 32. The piston  
9        42 is further provided with a relief cut 48 which receives the end  
10       disc portion 40 of the plug 32. The relief cut 48, in cooperation  
11       with the end disc portion 40, serves to interconnect the piston 42  
12       and the plug 32, both of which are slidably movable in the launch  
13       tube 10.

14               The receiver proximal end 23 is provided with a recess 50  
15       shaped complementarily to a distal end 52 of the piston 42.

16               The proximal end 14 of the launch tube 10 may be provided  
17       with stabilizing fins 54.

18               Referring to FIG. 3, it will be seen that in an alternative  
19       embodiment, the plug 32 includes an end portion 38 which includes  
20       opposed frusto-conical shaped portions 60, 62 received in a  
21       complementarily shaped relief cut 48.

22               A sealing ring 64 seals a joint between the receiver 22 and  
23       the collar 18, preventing leakage of air from inside the launch  
24       tube 10 during movement of the piston 42. Similarly, sealing  
25       rings 66 and 68 are seated in annular grooves 70, 72 in the piston

1 42 to prevent leakage of air between the piston and the launch  
2 tube 10.

3 In this embodiment, the receiver recess 50 is of a curved  
4 configuration and the piston distal end 52 is complementarily  
5 shaped, providing for an even distribution of compressive force  
6 over the two surfaces 50, 52 and dissipation of heat in operation  
7 of the assembly.

8 In operation, the proximal end 14 of the launch tube 10  
9 receives in a cavity 56 the muzzle and flash suppresser of a rifle  
10 (not shown) such that the flash suppresser is essentially flush  
11 with the plug planar portion 36. The butt of the rifle is placed  
12 against the ground or other support and inclined at a selected  
13 launch angle. The rifle is fired in the usual manner.

14 A bullet leaving the rifle impacts the plug 32 which is of a  
15 selected material such as a polymer, lead, soft aluminum, copper,  
16 brass, and composites or alloys thereof, or other material adapted  
17 to receive and appreciably slow the bullet. The bullet embedding  
18 in the plug 32 drives the plug 32 and the piston 42, which  
19 preferably is of hardened or cold-rolled steel, distally, such  
20 that the piston distal end 52 impacts the receiver 22 in the  
21 receiver recess 50 and compresses air in the recess 50, such that  
22 the bullet is dynamically decelerated. The compressed air, and  
23 expanding powder explosion gases from the rifle cartridge, and the  
24 violent impact of the piston on the receiver proximal end recess

1 50, serve to lift the launch assembly and the projectile 30 off of  
2 the rifle.

3 If the launch assembly is recovered, the receiver 22 can be  
4 unscrewed from the collar 18 and the piston 42 and plug 32  
5 removed. The plug 32 can then be withdrawn from the piston 42,  
6 the relative softness of the plug permitting withdrawal of the  
7 plug end disc portion 40 from the relief cut 48 in the steel  
8 piston. A new plug 32 is then inserted in the piston recess 46.  
9 The piston 42 and new plug 32 are then slid down the launch tube  
10 10 until the plug planar portion 32 is disposed adjacent the  
11 dimple 16. The receiver 22 is threaded back onto the collar 18 to  
12 place the launch assembly in condition to receive another  
13 projectile for launch.

14 Referring to FIG. 4, it will be seen that in a further  
15 alternative embodiment, the plug 32 includes an end portion 38  
16 which includes a frusto-conical portion 34 which, in turn,  
17 projects distally from a cylindrical portion 80 provided with a  
18 planar proximal end portion 36.

19 The plug 32 is of a high-density metallic, polymeric or  
20 cellulose material and in this embodiment is held in the piston 42  
21 by screws 82 disposed in bores 84, the screws 82 projecting  
22 radially inwardly and engaging the plug cylindrical portion 80 to  
23 interconnect the plug 32 and the piston 42. A circular rubber or  
24 polymer washer 86 is held on the proximal end 44 of the piston 42  
25 by the plug planar portion 36.



1           A circular bulkhead 88 is slightly oversized diameter-wise  
2           and is press-fitted into the launch tube 10 proximate the dimple  
3           structure 16. The bulkhead 88 is provided with a central aperture  
4           90 which is slightly larger than the caliber of bullet fired from  
5           the rifle being used for launch.

6           As shown in FIG. 4, the collar 18 may be sufficiently  
7           elongated to extend proximally on the launch tube 10 to slightly  
8           beyond the dimple structure 16. The collar 18 may be provided  
9           with dimple structure 92 complementary to, and engageable with,  
10          launch tube dimple structure 16.

11          Upon firing of the rifle, the bullet (not shown) passes  
12          through the aperture 90 and embeds in the plug 32, and moves the  
13          plug 32 and the piston 42 distally in the launch tube 10. The  
14          washer 86 moves with the plug 32 and piston 42. The distal  
15          movement of the piston 42 compresses air between the piston and  
16          the receiver 22 and dynamically decelerates the bullet movement.  
17          Gas from the bullet powder charge enters the growing volume  
18          between the bulkhead 88, which remains stationary, and the washer  
19          86, which moves distally with the plug 32. The gas expansion in  
20          the space between the bulkhead 88 and the washer 86 exerts  
21          pressure on the washer, creating an improved seal between the  
22          washer and the interior sidewall of the launch tube 10. The  
23          aforesaid space develops into a safety chamber which traps  
24          unburned powder particles and debris from the plug and the bullet.

1           Upon retrieval of the used launch assembly, the receiver 22  
2           may be unscrewed from the collar 18 and the piston 42, plug 32 and  
3           washer 86 removed from the launch tube 10. The plug 32 and washer  
4           86 are removed from the piston 42 by loosening the screws 82. A new  
5           plug 32 and washer 86 are connected to the piston 42 and the  
6           piston, plug, and washer assembly is moved through the launch tube  
7           10 to the position shown in FIG. 4. The receiver 22 is screwed  
8           onto the launch tube distal end 12 to complete the reassembly.  
9           The launch assembly is then in condition for re-use.

10           There is thus provided projectile launch assemblies suitable  
11           for providing a projectile launch capability for a rifle and which  
12           can be used multiple times with replacement of only a portion  
13           thereof, thereby realizing significant economies. There is  
14           further provided a method for launching a projectile from a rifle,  
15           including use of a launch device which is for the most part  
16           reusable.

17           It will be understood that many additional changes in the  
18           details, materials, steps and arrangement of parts, which have  
19           been herein described and illustrated in order to explain the  
20           nature of the invention, may be made by those skilled in the art  
21           within the principles and scope of the invention as expressed in  
22           the appended claims.